Citation:

Rosell M, Appleby P, Spencer E, Key T. Weight gain over five years in 21, 966 meat-eating, fish-eating, vegetarian and vegan men and women in EPIC-Oxford. *Int J Obes* (Lond). 2006 Sep; 30 (9): 1,389-1,396.

PubMed ID: 16534521

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To assess changes in weight over five years in meat-eating, fish-eating, vegetarian and vegan men and women.

Inclusion Criteria:

- Participant in the Oxford arm of the European Prospective Investigation into Cancer and Nutrition (EPIC-Oxford), which consists of men and women who were aged ≥20 years and living in the UK between 1993 and 1999
- EPIC-Oxford study participants who completed the five-year follow-up questionnaire and had no prevalent malignant neoplasm at baseline.

Exclusion Criteria:

- Subjects were excluded if weight and height were measured and not self-reported
- If anthropometric data were missing
- If the change in body weight between baseline and follow-up exceeded 20kg
- ≥70 years of age
- If they had suffered a stroke, heart attack, angina, diabetes at baseline
- If the diet group was unclear at baseline or follow-up
- If values of any other variables in the analyses were missing.

Description of Study Protocol:

Recruitment

- The EPIC-Oxford study aimed to recruit participants with a wide range of diets by targeting vegetarians and vegans, as well as the general UK population

- Participants were recruited through collaborating general practitioners or by post via vegetarian and vegan societies, vegetarian and health food magazines, or were friends or relatives of other participants.

Design

Prospective cohort study.

Dietary Intake/Dietary Assessment Methodology

- Classification of diet groups was based on four questions:
  - Do you eat any meat (including bacon, ham, poultry, game, eat pies, sausages)?
  - Do you eat any fish?
  - Do you eat any eggs?
  - Do you eat any dairy products (including milk, cheese, butter, yogurt)?
- Based on these data at baseline and follow-up, six diet groups were defined. Those who had not changed their diet during the follow-up period were either a meat-eater, fish-eater, vegetarian, orvegan. Those who had changed their diet during follow-up were either considered reverted or converted
  - Meat-eater: Ate meat
  - Fish-eater: Those who did not eat meat, but ate fish
  - Vegetarian: Those who did not eat meat or fish, but ate eggs and/or dairy products
  - Vegan: Those who did not eat any food of animal origin
  - Reverted: Those who had changed their diet by one or more steps in the direction of vegan, vegetarian, fish-eater, meat-eater
  - Converted: Those who had changed their diet in the by one or more steps in the opposite direction as 'reverted'.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- The association between weight gain and dietary group was analyzed using multiple linear regression, adjusting for potential confounders
- Data for men and women were analyzed separately.

Data Collection Summary:

Timing of Measurements

Variables were measured by questionnaire at baseline and approximately five years later.

Dependent Variables

- Body mass index (BMI): Calculated using self-reported height and weight
- Weight gain: Self-reported weight at baseline and follow-up.

Independent Variables

Diet group (self-reported meat-eater, fish-eater, vegetarian, or vegan; or classified as reverted or converted).

Control Variables

- Physical activity
- Smoking
- Married
- Current paid job
- Age at leaving school
- Age at menarche
- Age, height and weight at baseline.

Description of Actual Data Sample:

- *Initial N:* 36,956 (completed five-year follow-up)
- *Attrition (final N):* 21,966 (after applying exclusion criteria) (75% female)
- *Age:* Mean (SD) for men and women at baseline was 46.1 (11.5) and 43.1 (11.8) years, respectively
- *Ethnicity:* Not reported
- *Other relevant demographics:* None
- *Anthropometrics:* Mean (SD) of BMI at baseline for men and women was 24.1 (3.1) and 23.4 (3.7)kg/m^2, respectively
- *Location:* UK.

Summary of Results:

Weight Gain[a] (grams per year) in 21,966 Mean and Women by Diet Group

Diet Group	Men Mean (95% CI)	Women Mean (95% CI)
Meat-eater	406 (373, 439)[b]	423 (403, 443)[b]
Fish-eater	377 (298, 456)	338 (300, 376)**
Vegetarian	386 (339, 433)	392 (364, 420)
Vegan	284 (178, 390)*	303 (211, 396)*
Reverted	468 (374, 563)	433 (388, 479)
Converted	242 (133, 351)**	301 (238, 365)**

[a]: Adjusted for physical activity, smoking, married, current paid job, age at leaving school, age at menarche (women), age at baseline, height at baseline, weight at baseline

[b]: Reference group for testing differences in means

*P<0.05

**P<0.001

Other Findings

- Compared with meat-eaters, mean annual weight gain was lower in vegans (P<0.05 for both men and women) and fish-eaters (P<0.001 for women only)
- The lowest mean weight gains were seen in men and women classified as converted, in whom the mean annual weight gain was 40 and 29% smaller, respectively, compared with the mean annual weight gain in meat-eaters (P<0.001 for both men and women).

Author Conclusion:

- The average weight gain over five years in a population of meat-eating, fish-eating, vegetarian, and vegan men and women in the UK was approximately 400g per year
- A significant, although small, difference in weight gain (approximately 300g per year) was observed in the vegans compared to the meat-eaters, and for women, also in the fish-eaters compared to the meat-eaters.

Reviewer Comments:

Author comments:

- *The EPIC-Oxford study involves subjects who are more health conscious than the general UK population (vegans and vegetarians were targeted at recruitment)*
- *Although weight and height were self-reported, bias is not expected because change in weight was considered.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions		
1.	**Was the research question clearly stated?**	Yes

1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes

4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	???
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes

7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	???
7.5.	Was the measurement of effect at an appropriate level of precision?	???
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	No
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes